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ABSTRACT

The Open University of Great Britain provides home-based instruction via broadcasts and correspondence. Since technical arguments for the superiority of open-network, cable, or cassette television systems are inconclusive, the university has been forced to develop a decision-making model to determine which system is the most cost effective. For each system the following characteristics must be considered: 1) student characteristics; 2) instructional characteristics; 3) flexibility; 4) available technology; and 5) type of evaluation. These characteristics must be weighed against the costs of the required development, production, transmission, distribution, software, and hardware. The resulting ratio of bundles of characteristics to cost will enable the Open University to select the system which most effectively resolves the institution's video-distribution problems. (EMH)

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EDUCATIONAL AND COST COMPARISONS BETWEEN
OPEN-NETWORK , CABLE AND CASSETTE SYSTEMS
OF MULTI-MEDIA TEACHING

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Introduction

"The technical arguments for the superiority of any one system over another are not decisive. Neither are the economic factors so clear-cut as to suggest that any one system should be rejected out of hand ... The decisions that determine the choice of system to install can therefore be primarily educational ones."

"At the final resort many questions of educational provision resolve in arguments about finance."

Both these statements are taken from a recently published report by Britain's National Council for Educational Technology. This report compares various systems of video distribution (NCET, 1973). The two statements bring out nicely the importance of the relation between educational requirements and cost factors. Educational requirements are never absolute. What is desirable is determined to a large extent by what is feasible financially. A basic question facing many educational and training organisations is: what video distribution method should we chose? It is not just the rapid technological developments taking place that make this decision so difficult. It is also the slippery nature of educational "requirements," which change according to the kinds of costs involved.

Because of this interaction between educational and cost factors, it is argued that we need to build some kind of decision MODEL in which to handle all the various factors involved in such a decision. Once we have our model built, then we can try out various possible solutions, and then see how the various factors - including educational requirements - are affected. It will help to see how the development of the model can assist in making decisions by looking at a specific instance - the decision facing the Open University about what methods of video distribution it will require by the year 1981. Although the Open University is a unique institution,

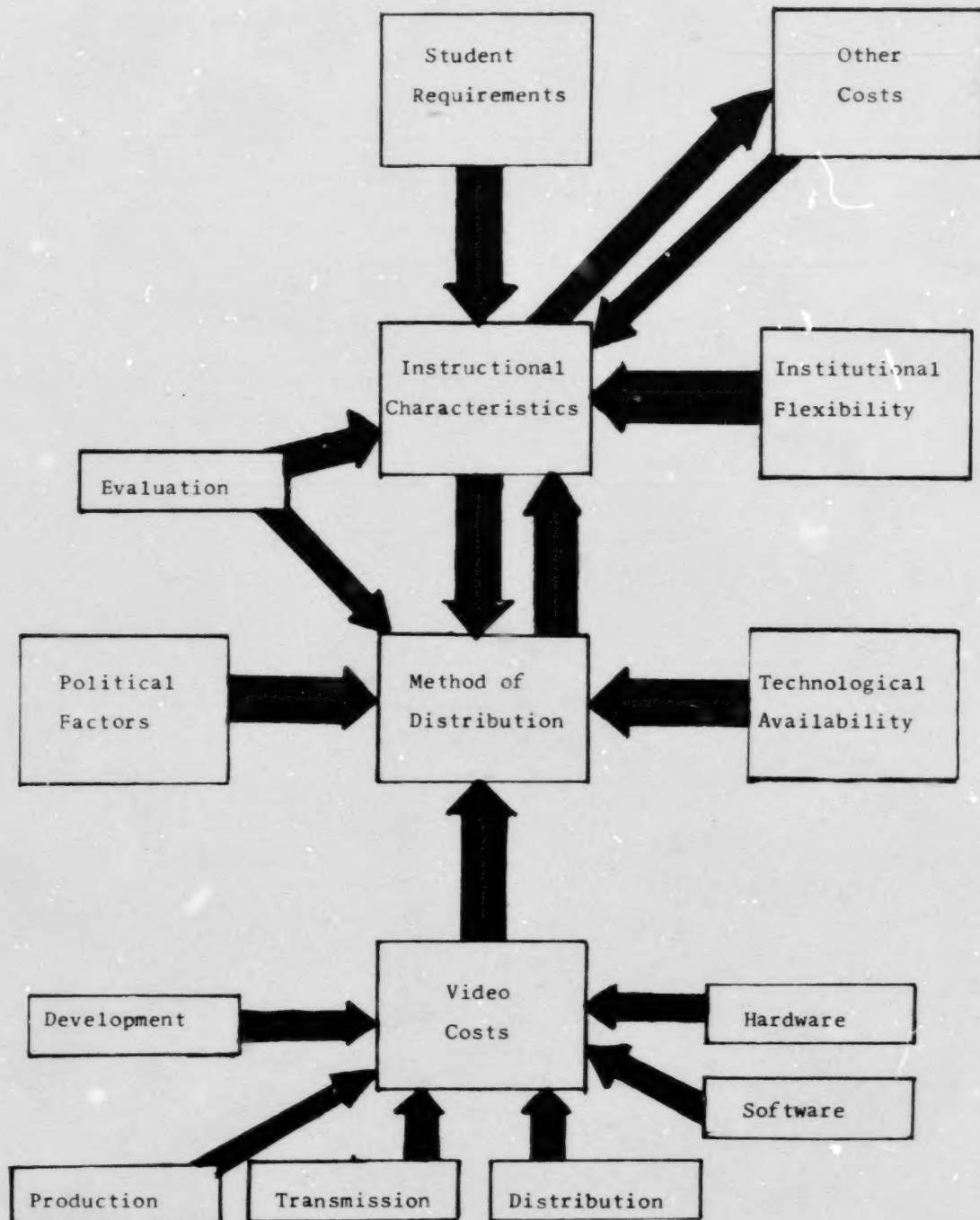
there are certain advantages in using it as material for the model:

- 1) many of the factors affecting the Open University's decision will in fact apply to any system of teaching or training working adults in large numbers - an increasingly important field of development in most countries;
- 2) the Open University has already made a decision up to 1981, and therefore we now know many of the factors which need to be taken into consideration - and we have "real" data to put into the model;
- 3) the model should really be independent of the actual example used - the "weighting" or importance of some factors may turn out to be zero, but at least they should be considered. Thus if our model is successful, it should apply to any organisation or system wishing to make a decision.

The Model

The model is set out in detail in Figure 1. Ideally, one would like to match directly "educational requirements" with costs, from which would emerge the most appropriate distribution system. If there were clear-cut cost differences associated with the various distribution systems, and there were no other factors besides educational requirements and costs to be considered, the decision would be comparatively easy to make. Just compare the costs of the various distribution systems, and see what you lose in terms of educational requirements by using the cheapest. Proceed until you reach the system which balances the maximum educational requirements with the maximum costs that can reasonably be afforded. Unfortunately, however, life is not so simple. There are a number of other crucial factors to be considered besides "educational requirements" and costs; "educational requirements" is a term which covers a host of factors; and as the NCET report has stated, the economic factors are not so clear-cut. It will be necessary therefore to explain

A Model for Determining the Most Appropriate Method of Video
Distribution, and for Examining its Likely Effects on
Student Requirements and the Instructional Characteristics
of the System



the model in two stages. The first will be to list all the factors which bear on the decision, and to provide data based on experience from the Open University; the second will be to show how the model would react to various changes in the factors and data provided.

Educational Requirements

The first step would be to identify the educational requirements of the teaching system. This is a very loose term, and as you will see from the model, it has been broken down into two major sub-headings: requirements associated with anticipated student characteristics; and requirements associated with the anticipated methods of teaching. Obviously, these two are related, but it is important to rank or group the separate requirements into order of importance, and this may cut across the two sub-groups.

(a) Student characteristics

All systems need to identify very clearly the target of their teaching audience (Trenaman, 1967), so that material can be produced at the appropriate level. The usual data collected for this purpose are age, sex, previous educational qualifications, etc. For the purpose of making a decision about video distribution systems, however, other, less usual, student characteristics will be just as important. These are listed in Table 1, together with the Open University's decision regarding the characteristics with which it is primarily concerned.

It becomes clear from this listing that the Open University student must be taught part-time, on an individual basis, primarily at home. Some of the characteristics in Table 1 in fact will be found to be unimportant in affecting decisions about the most suitable video-distribution system for Open University students, but nevertheless it is necessary to list all factors which are essential features of the intended teaching system. This is necessary, because it will not always be possible to predict in advance those characteristics which may be affected. (You may like to guess which of the characteristics in Table 1 in fact are unlikely to be affected by the choice of distribution system).

TABLE 1. Main characteristics of students to be catered for,
irrespective of system of distribution

Student Characteristics	Open University Decision	O.U. Educational Priority
Age	Adults (21 or over)	Essential
Previous educational qualifications	None necessary	Essential
Occupation	Full-time workers	Essential
"	Wide cross-section	Desirable
Geographical distribution	National, (regionally balanced, including remote areas)	Essential
Density of distribution	Scattered, even isolated	Essential
" " "	Study centre support	Desirable
Number of students	Large (over 35,000)	Essential
Sex	Male and female balance	Desirable
Motivation	Students who want degrees	Essential
"	" " " continuing higher education	Essential
Access to centres	Physically handicapped; institutionalised (sick, or prison); too remote or poor transport	Essential

Further information may need to be collected regarding some of the characteristics. For instance, if we are intending to provide a system for working adults, we need to know at what times the relevant student population is at home. Figure 2 shows these times for Open University students (see McIntosh, 1972). We also need to know the coverage of existing video-distribution systems. These are listed (for 1972) in Table 2.

FIGURE 2

PROPORTION OF STUDENTS AT HOME AT VARIOUS TIMES - BY INTENDED FACULTY

(MONDAY-FRIDAY)

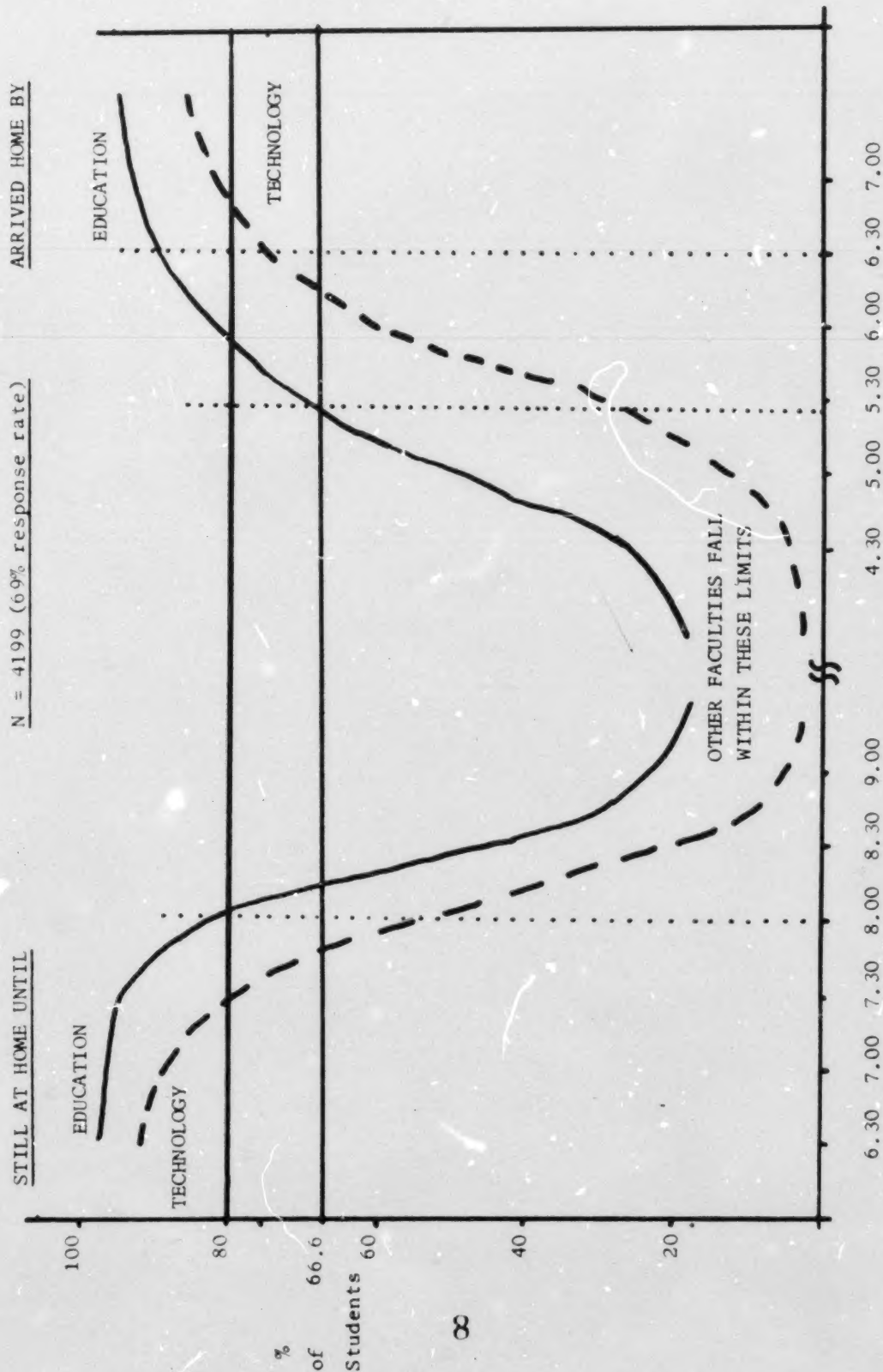


Table 2. Access to various video-distribution systems in Great Britain, 1972.

	% of total population
VHF-405 line television transmission (BBC1)	99.5%
UHF-625 line television transmission (BBC2)	92% (99.5% by 1985)
Cable television	12%
Video-cassette recorders	Negligible

Given the need to provide national coverage in student homes, the decision of the Planning Committee in 1967 to seek open-network time on BBC2 (which at that time had spare transmission time) was obvious. (The situation for 1981 however will not be so obvious, as we shall see). We also need information, in the Open University situation, on the use made of study centres and broadcasts. Since we had no prior knowledge of how our students would react, we should compare differences in the use of study centres and broadcasts. For instance, if most students do manage to attend study centres, even though these are not compulsory, this would obviously be relevant to a decision on the system of video distribution we adopt in 1981. The figures in Table 3 support the Planning Committee's decision to make the University's teaching system primarily home-based:

Table 3. Proportion of Students Viewing Programmes and Visiting Study Centres.
Foundation Courses, 1971: Weeks 9-20

	Arts		Social Sci.		Maths		Sciences	
	Median Range		Median Range		Median Range		Median Range	
	%	%	%	%	%	%	%	%
Television (at all)	88	73-91	92	88-94	90	33-95	95	92-98
" (at home)	78	74-84	83	82-86	82	80-86	84	82-87
" (at study centre)	22	9-25	17	10-22	21	10-24	18	8-28
Visited study centre	46	32-55	47	39-64	52	36-71	39	24-61

(Source: Course Unit Report Form, N.E. McIntosh, I.E.T., Open University.)

Although most students view at home, however, the back-up support of programmes at study centres was used on average by approximately one-fifth of students each week (i.e. by about 4,000 students each week).

We will find, in fact, that information will be required on several other aspects of student characteristics before a decision can be made, but this will be discussed later.

(b) Instructional Characteristics.

The teaching methods adopted should be determined by the needs of the students for whom the system is being designed. These needs for Open University students have been set out in broad detail in Table 1. The teaching methods to be adopted by the system are in fact a crucial part of the decision-making model, for they act as a buffer between the constraints imposed by the economic and technical limitations of the available methods of video-distribution, and the needs of the student. In other words, whatever constraints are thrown up by the method of video-distribution finally adopted, these must be accommodated whenever possible by adapting the teaching methods, not by sacrificing the needs of students to traditional but perhaps inappropriate methods of teaching. A list of possible instructional characteristics which need to be considered before introducing or changing a video distribution method are listed in Table 4; and summarised in Figure 3.

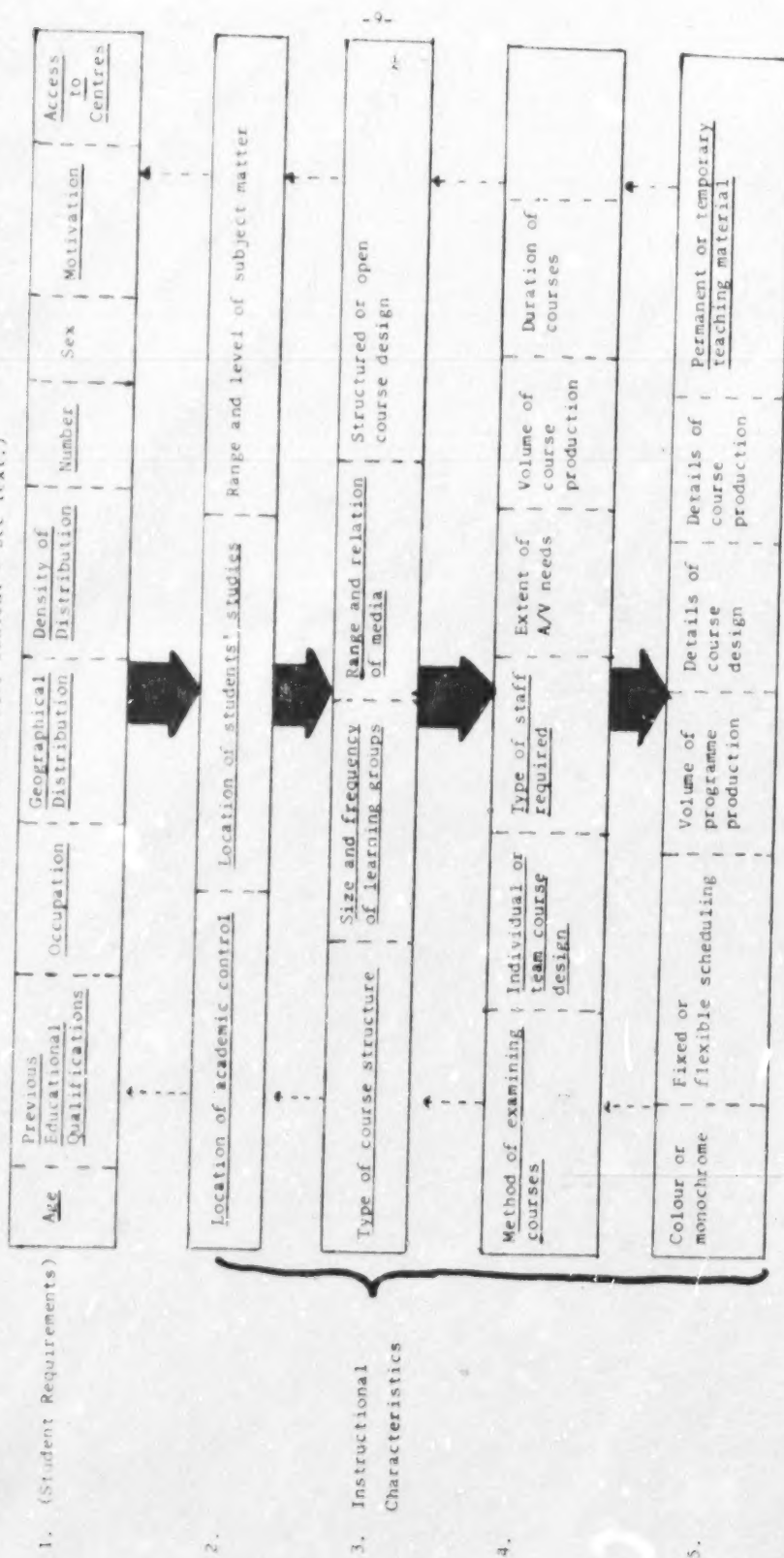
The choice of instructional characteristics for a system requires a decision-model of its own. There is a logical sequence of events, earlier decisions affecting those made later, etc. There is interaction between decisions within each "level", also. Finally, some of the "later" decisions may force earlier decisions to be altered. It will be seen, however, that in general, decisions can more easily be altered at level 4 or 5 than at 2 or 3. If changes are necessary at level 2, then all subsequent decisions may need altering. It is also important to differentiate between decisions which are essential for meeting the specific needs of students, and those which are only desirable. If decisions have to be changed

Figure 3

ORDER OF DECISIONS AFFECTING INSTRUCTIONAL

CHARACTERISTICS OF A TEACHING SYSTEM

(Decisions underlined are "essential" in O.U. context - see text.)



<u>Instructional Characteristics</u>	<u>Order of Decisions</u>	<u>Open University Decision</u>	<u>O.U. Priority</u>
Location of academic control.		<u>Central</u> : to ensure maintenance of degree standards; to control production process.	Essential
Main location of students' studies.	2	<u>Home</u> : significant numbers cannot regularly attend study centres.	Essential
Range and type of subject		<u>Wide range of subject</u> - single and inter-disciplinary courses: six Faculties (Arts, Maths, Social Sciences, Science, Educational Studies, Technology), to provide wide choice for students; to meet definition of a "University".	Desirable
Type of course structure.		<u>Self-contained, accumulating credits</u> : to break up length of part-time studying; to allow for flexible exemption policy.	Essential
Size and frequency of learning groups.		<u>Individual, but paced</u> : students home-based; to keep students progressing through course	Essential
	3	<u>Groups up to 20</u> : for remedial or self-help purposes.	Desirable
Range and relation of media.		<u>Multi-media</u> : subject requirements (e.g. Science) demand audio/visual presentation in absence of general student access to educational premises; a/v media alone cannot carry all the desired instruction in time available (see text).	Essential
		<u>Integrated</u> : to concentrate teaching resources more powerfully and economically.	Desirable
Structured or 'open' course design.		<u>Structured</u> : heterogeneous student population; distance-teaching requires communications to be explicit.	Desirable
Method of examining courses.		<u>Continuous (assignments) + end-of-course examination</u> : to pace students; to check "identity".	Essential
Individual or team course design.		<u>Team</u> : multi-media; interdisciplinary courses; structured course design; publishing and production constraints.	Essential
Type of staff required.		<u>Central university academics</u> : to ensure degree standard <u>Professional production staff</u> : to work in the teams; to produce high quality product.	Essential Essential
	4	<u>Regional (full-time) academics</u> : to organise and monitor regional services. <u>Regional (part-time) academics</u> : to provide tuition and counselling; to assess students' work.	Essential Essential
Extent of requirement for audio/visual material.		<u>25 minutes, every weeks' work (television and radio)</u> : pacing; subject demands; to integrate with printed material.	Desirable
Volume of course production.		<u>110 undergraduate credits, + post-experience credits, by 1981</u> : to provide wide-range of choice, specialist and inter-disciplinary.	Desirable
Duration of courses		<u>4 years</u> : to allow for improvements, up-dating, and replacement by new courses.	Desirable
Colour or monochrome temporary or permanent fixed or flexible scheduling.		<u>Colour (by 1981)</u> : subject demands; marketing requirements. <u>Permanent</u> : necessary for students at home to have materials available <u>Fixed</u> : pacing; part-time students need regular pattern; administrative constraints.	Desirable Essential Desirable
Volume of programme production and transmission.	5	<u>30 programmes per week produced, 100 programmes per week transmitted</u> : One programme per unit, repeated, and re-made every four years.	Desirable
Details of course design.		<u>Varied</u> .	Flexible

Media.		audio/visual presentation in absence of general student access to educational premises; a/v media alone cannot carry all the desired instruction in time available (see text).	
		<u>Integrated:</u> to concentrate teaching resources more powerfully and economically.	Desirable
Structured or "open" course design.		<u>Structured:</u> heterogeneous student population; distance-teaching requires communications to be explicit.	Desirable
Method of examining courses.		<u>Continuous (assignments) + end-of-course examination:</u> to pace students; to check "identity".	Essential
Individual or team course design.		<u>Team:</u> multi-media; interdisciplinary courses; structured course design; publishing and production constraints.	Essential
Type of staff required.	4	<u>Central university academics:</u> to ensure degree standard <u>Professional production staff:</u> to work in the teams; to produce high quality product. <u>Regional (full-time) academics:</u> to organise and monitor regional services. <u>Regional (part-time) academics:</u> to provide tuition and counselling; to assess students' work.	Essential Essential Essential Essential
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Duration of courses		<u>4 years:</u> to allow for improvements, up-dating, and replacement by new courses.	Desirable
Colour or monochrome		<u>Colour (by 1981):</u> subject demands; marketing requirements.	Desirable
Temporary or permanent		<u>Permanent:</u> necessary for students at home to have materials available	Essential
Fixed or flexible		<u>Fixed:</u> pacing; part-time students need regular pattern; administrative constraints.	Desirable
Scheduling.			
Volume of programme production and transmission.	5	<u>30 programmes per week produced, 100 programmes per week transmitted:</u> One programme per unit, repeated, and re-made every four years.	Desirable
Details of course design		<u>Varied.</u>	Flexible
Details of course production.		<u>Varied.</u>	Flexible

then those which are not essential should be examined first.

It should be emphasised that what we are doing at this stage is producing an ideal model of the instructional characteristics of the system, irrespective of the method of distribution to be adopted. Many of these decisions will, of course, have to be altered or modified when we come to look at the implications of one system of distribution against another. Without a prior statement however of the kind of instructional system desired, there may well be a tendency to bend not only the instructional characteristics but even the students' requirements to fit pre-conceived or "political" views of the kind of video distribution system required.

It is also necessary to point out that some of the decisions that need to be made will prove to be extremely difficult. Nowhere is this more true than in determining the extent of audio-visual requirements. Even in the Open University situation, where face-to-face contact can more or less be discounted, it is extremely difficult to know the exact audio-visual requirements for each course or unit of work, even when the course is being written. For instance, the mere availability of video-teaching helps determine not only the objectives of certain courses, but also what kind of courses we put on in the first place (see Bates, 1973). The "need" for audio-visual resources is not a sole consequence of the subject matter being taught, since it appears that many learning objectives can be achieved equally effectively through a variety of media (Chu and Schramm, 1967). On the other hand, there are specific learning functions which it would be extremely difficult to achieve without television in the Open University situation (Bates, 1972). Nevertheless, setting this decision within the general framework of a decision-model makes an assessment of the audio-visual requirements for the system much more realistic, since the decision can then take account of other factors - such as the students' study location - as well as subject matter requirements.

Institutional Flexibility

Instructional methods should be the outcome or product of two pressures: the needs of students; and the practical and cost constraints on the system (including those arising from a chosen

method of video distribution). This may appear obvious, but if the logic is accepted, it has serious consequences for the organisation and operation of conventional teaching institutions, whether they be schools, universities, or training establishments. No changes are introduced in a vacuum. If existing instructional methods cannot be adapted to meet satisfactorily the needs of students and the constraints imposed by any of the available methods of video distribution, then the whole idea of using video material should be seriously questioned. It is not usually pedagogic difficulties that cannot be resolved, but administrative and organisational rearrangements that would become necessary in any existing institution or institutions, if methods of video teaching are to be fully optimised. Therefore the flexibility of an organisation, or its willingness to change its methods of instruction to meet the requirements of a video-teaching system, is crucial.

Technological Availability

The choice of method of distribution is bound to be influenced by the current or not too distant availability of various methods of video distribution systems. As far as the Open University is concerned, there are the following possibilities for 1981:

- (a) continued - but extended - use of BBC 2 open-network transmission;
- (b) the setting-up of a fourth national UHF network, primarily for educational and/or community use, in which the Open University would have a share;
- (c) the replacement of the current VHF "405 line" network, in the 30-300 MHz band, with a re-engineered 625-line network, again providing an educational and/or community channel (possible from 1985 when UHF coverage is extensive);
- (d) the dropping of "radiative" programmes, and replacing them with:
 - (i) nothing.
 - (ii) audio-vision (i.e. sound cassette or record + printed diagrams).
 - (iii) a video-cassette or disc system, study-centre based.
 - (iv) Some form of audio-cassette/film slide system yet to be designed.

Costs

Costs can be divided into several separate components:

(i) Development costs

These are the costs of setting up a new system of distribution, or of inventing, developing or building the equipment necessary for the system of distribution. Educational institutions - at least in Britain - do not normally contribute to development costs, but usually get a "free ride" once it is installed. Alternatively, development costs are recovered - and hence hidden - in the cost of hardware or rental. Development costs are crucial though in persuading governments or other bodies to invest in a particular system of distribution. The Open University of course paid no direct development costs for its video-distribution system, merely using an already established service (BBC 2).

(ii) Production costs

These are the costs of making the programmes, and these in turn can be broken down into direct and indirect costs. Direct costs increase according to the number of programmes made, and, if salaries are excluded, the major component of direct costs is the programme budget. In the Open University, this ranges between £600-£1000 per television programme. The indirect costs include "overheads" (cost of maintaining buildings, salaries, services, etc). The total broadcasting cost of the Open University in 1973 was £1.97 million. (This included £100,000 transmission costs - see below). During 1973 approximately 300 x 25 minute television programmes, and 350 x 20 minute radio programmes, will be made. Production costs need not be influenced by methods of distribution, but in an open-network system such as the Open University, there is obviously pressure to provide high-quality production. Furthermore, the greater capital investment required by open-network systems will usually mean in effect more money spent on productions, either directly or indirectly.

(iii) Transmission costs

The Open University will probably be paying approximately £250,000 per year for 30 hours broadcasting per week, - or, in a 32 week year, about £270 per hour. (This includes early morning transmissions, which increase the cost, because of bringing in technical staff specifically for these early morning transmissions.)

Transmission costs are much more difficult to estimate on cable television and cassette systems. Since there is no national cable television system in Britain, it is not possible to provide a comparable transmission figure. The main "transmission" costs of cassettes would be postage, which, with packaging, would come to approximately 25p. per mailing. (If cassettes have to be returned, this increases to 50p. per mailing.)

(iv) "Opportunity" costs

In Britain, the Government controls access to the broadcast media. In effect, the Independent Broadcasting Authority and the British Broadcasting Corporation are the only two bodies allowed to use open-network transmissions in Britain. The Open University therefore is in a very special and privileged position. There is no "charge" for this opportunity. However, if the government in Britain should decide to extend the idea of community broadcasting, and make available time to other institutions, this special arrangement may come under pressure. In practice, any figure set would be arbitrary, although it is a factor to be considered in a model.

(v) Distribution costs

There are, of course, no distribution costs for open-network broadcasts (unless one includes the cost of supplementary printed materials). The main distribution costs associated with cable television are either those of rental, or those of installation or connection to another system (although these might be included in development costs.) What will soon be required in Britain will be direct cable-to-cable link-up between different cable systems. As cable systems develop, either on a random or a planned basis, the more important it will become for subscribers covered by system A also to be able to hook up with Systems B, C, D, etc. It will also remain important for subscribers to cable TV systems to be able to select open-network or ITFS (directional) services. Thus as well as rental costs, it is likely that there will be costs related to usage (as in Pay-TV or the present telephone system).

(vi) Student Hardware costs

The Open University has two enormous benefits in its video-distribution method. Apart from having no distribution costs, it also has no student-hardware costs. The television sets are already owned - or assumed to be owned - by the students.

(Even in the study centres, many of the sets used were already installed for the host institution.) The University is interested in the possibility of VCR machines in its 250 student-centres. This would involve the University in an initial outlay of £90,000 - or an annual capital cost of about £20,000, given a 4/5 year machine-life. (To provide every student with a VCR machine would involve a capital cost alone of nearly £3 million per year). The University would also be interested in a linked audio-cassette/slide or film-loop system, for home use (hence a market of at least 45,000), provided a reliable machine could be produced at a cost of not more than £30 each and software at less than £1 per hour. (The University already issues £12 audio-cassette recorders to students on two specific courses). Even systems such as Selectavision or CVR XII, which are trying to develop video-discs costing less than £5, would still be unsuitable for home-based systems, since the machines themselves are so expensive. Cable television itself will also be unacceptable for home study unless the cable system is extensive or standard in the area. In other words, if students have to be provided with or buy special sets, then the cost becomes prohibitive.

(vi) Student Software Costs

Neither open-network nor cable television has software costs, i.e. costs of cassettes, films, discs, etc. These costs, in a large system such as the Open University, can escalate rapidly. When the University was set up, it negotiated a contract to provide super-8 mm. film-copies, with optical sound tracts, in cassette form, of all its programmes for use at study centres. The film-cassettes cost £12 each. Quite apart from the hardware costs (300 machines at £150 = £75,000), in the first two years of operation the software costs had rocketed to £¼ million. This was made up as follows:

1971. Foundation courses (5): 34 programmes x 5 = 170 programmes
 12 regions, 4 copies of foundation course programmes
 per region = $170 \times 4 \times 12 = 8,160$ copies.
1972. Second-level courses (11): 270 programmes (fewer
 programmes per course at second level)
 12 regions, 2 copies per programme: $270 \times 4 \times 12 = 12,960$ copies
- 1971 + 1972 : $8,160 + 12,960 + 440$ library copies = 21,560 copies
- At £12 per copy : $21,560 \times £12 = \underline{\underline{£258,720}}$

Seeing that the University had produced only 16 out of its intended 110 full credits, it may not come as a surprise to learn that the University has suspended the film cassette system for 1973, and placed it under review, especially since no more than 5% of students in any one week ever used the film cassette machine.

Now it just so happens that the cost of a Philips VCR cassette and machine is not so very different from that of the film-cassette equipment. There are however five important operating differences:

- (a) the VCR cassettes can be wiped and used again - probably up to 250 times.
- (b) the VCR cassettes can accommodate two programmes (one hour) at only slightly higher cost (£15, compared with £12).
- (c) the VCR records off-air - and plays back in colour (thus giving the possibility of savings on mailing costs.)
- (d) the VCR provides a better picture.

The Open University has in fact provided five study centres with VCR machines, and we are currently watching very carefully their progress through 1973. We will see later how the VCR system obviously has considerable potential for the Open University's study centre system.

It has been only too clearly demonstrated how software costs can escalate, even at study-centre or group learning level. Even if the technology of providing cheap audio-visual equipment (less than £30 a machine) in the home could be solved, the problem of software costs to home-based students will remain. Postage and packaging alone is likely to come to 25p. To provide 45,000 students with 15 hours per year of audio-visual material, (roughly equivalent to the television provision at the moment), cassettes costing £1 would involve in the University in an expenditure of £1 million per year, on the cassettes and machines alone. It can be seen therefore that the cost advantages of open-network broadcasts for home-based students are very strong indeed - and these advantages would also be true for cable-television, if it becomes as extensive.

"Political" Factors

No decision-model concerned with methods of distribution would be complete without reference to political and other outside pressures or resistances. In Britain, all methods of video-distribution, except specially manufactured cassettes, depend on licensing from the Post Office or Ministry of Environment. There are very strong commercial pressures for the fourth channel to be allocated to the Independent Broadcasting Authority. The controller of BBC Wales has - with reluctance - recommended the fourth channel be set aside for Welsh language programmes in Wales. The development of cable television is waiting not for technological advances but for political decisions. There are also formidable legal restrictions concerning copyright and the recording of material.

Similar pressures are evident at more "local" levels. There are many competing claims for scarce resources within educational establishments, and the money so lavishly spent on video systems is quite understandably viewed with scepticism and envy by other departments or spending units.

Decisions on the kind of video-distribution must therefore call for an acute awareness of likely political and economic moves in the future, both within and outside the system. Indeed, it may not be enough to adapt one's system to the prevailing economic and political climate. It may be necessary to attempt to influence such decisions, for the system to survive. Hence the Open University is now, as an institution, strongly supporting the allocation of the fourth channel for educational and community uses, because of the pressures it is facing in finding sufficient transmission time.

Evaluation

There is insufficient space to describe the problems associated with evaluating a video-teaching system (see Bates, 1972b). It is sufficient here to mention that if decisions are to be evaluated, certain conditions may be necessary which may in themselves affect the decision. For instance, prior information collected for evaluation purposes may in itself become important in influencing the actual decision taken, and the knowledge that the effect of

decisions will be evaluated can itself (thankfully) inhibit or encourage certain kinds of decisions. In another sense, evaluation of the instructional characteristics of the system, in terms of their effectiveness in meeting the needs of students, may also be a force for changes in methods of video-distribution systems.

Applying the Model to the Open University Situation

The University's students are scattered nationally, and are primarily home-based. The University already has access to a national open-network system and an exceedingly harmonious relation with the BBC. There may therefore appear to be no problem. However, when the University was set up, it was not very clear what the level of course production might be, nor indeed what likely future developments there would be in broadcasting. As early as 1970, however, Lord Mountbatten, on officially laying the foundation of the first buildings of the Open University, was pointing to the need for a national cable system to meet the growing demands for video services, of which the Open University was a prime example, and in 1971, the University realised that there would be future problems of transmission time, and accordingly "rationed" the allocation of television programmes as follows:

Foundation courses (5): one programme per unit, a unit being one week's study (approximately 10 hours).

"Science-based" courses: one programme per unit.

"Arts-based" courses: one programme every two units.

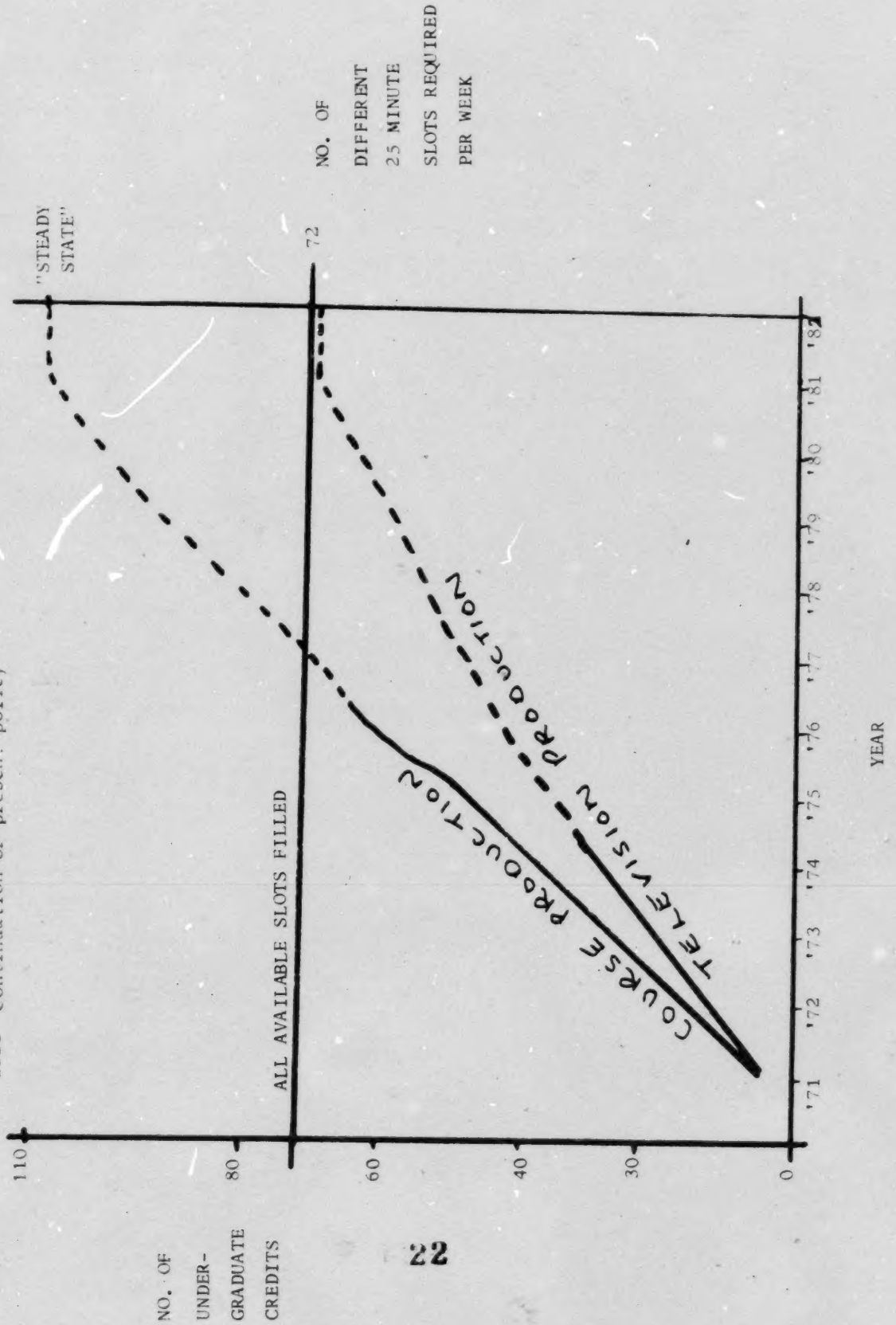
As the University has developed, this policy has been slightly modified in detail, but in general has survived. At the same time, it is now clear that the University intends to reach a "steady-state" of about 110 full undergraduate credits by 1981. (Students gain degrees by accumulating credits - six for a general degree, eight for honours). The effect these two policies will have on transmission schedules can be seen from Figure 4.

The University has an agreement with the BBC which gives us a total of 30 hours transmission time per week on BBC 2. This permits a maximum of 72 x 25 minute programmes per week to be transmitted. At the moment, the University transmits each programme twice, once during the week between 5.30 and 7.30 p.m., and once

Figure 4

ESTIMATED UNDERGRADUATE COURSE AND TELEVISION PRODUCTION

- Provisional decisions already made
- Continuation of present policy



at the weekend, between 9.00 a.m. and 1.30 p.m. These times together give a total of 19 hours per week. The University is using nearly all these "prime" slots in 1973 - yet it is offering a total of only 27 full credits. If present University policies continued, next year some programmes would have to be repeated at times outside these "prime" slots - probably before 7.00 a.m. Later, repeats would have to be progressively dropped, and eventually, all programmes (except possibly those for foundation courses) would be shown once only. Some programmes (probably for third or fourth level courses with small student numbers) would only be shown between 5.55 and 6.20 a.m.!

As it happens, no broadcasting decisions have yet been made beyond 1974, so we can use the model to try out various alternatives. We must not only look at the costing of various alternatives, but also examine how they are likely to affect the instructional characteristics of the system - or indeed even student requirements.

(a) Better/More Hours on BBC 2 (or BBC 1)

The University in fact is the only body in Britain, outside the BBC and the commercial television companies, with regular access to open-network transmissions. It already therefore has a special and privileged relation with the BBC. While we can try to improve this relation to our advantage, the limits of manoeuvre are fairly narrow. We already have 19 hours a week at times when potential audiences can be measured in their millions. It would be unreasonable to expect a great deal more, especially since with 110 credits available, some broadcasts would not be seen by more than 30 students. Nevertheless, more or better times would certainly increase the effectiveness of the University in meeting its objectives.

(b) An Educational Television Channel

The fourth channel is "vacant" - we need more transmission time - why not give the fourth channel to the Open University, together with schools, further education, and community broadcasts? Estimates of the cost of an educational channel vary,

but perhaps the most reliable is capital (or "once-only") expenditure of £40 million, and running costs of £5 million per annum. Since the O.U. already spends £2 million per annum on broadcasting, the extra running costs would by no means be a heavy burden on the government. There is however strong competition (and opposition) to the education lobby, and nevertheless, even if a political decision was made now (which it won't be), it would take at least five years to set up an educational channel on a national basis, and therefore would not be of any use as a short-term solution. An educational and community channel is attractive however as a mid-term solution, and again would allow the main characteristics of the University - students and instructional - to be maintained.

(c) Cable Television

In parts of America, people have a choice of at least 12 channels, because they are on a cable system. In Britain, 12% of all homes are "wired-up", mainly through private companies like Rediffusion. However, these are very local services, usually relying on picking up national broadcasts on a centrally-located aerial. To wire-up 96% of the population would cost, at a minimum, £500 million, and even if work began now, it would take at least 10 years to create an extensive system. There are also formidable legal and copyright problems to overcome, not to mention "rights of way". Cable television is however the ultimate answer, not just to the Open University's problems, but to many other problems of communication. Again, this is primarily a political matter, outside the direct control of the University. Cable television though will only provide a long-term solution.

(d) Early morning broadcasts

Broadcasting between 5.50 a.m. and 7.30 a.m., seven days a week, will enable the University to take up the remaining 11 hours a week transmission time. (Late night television broadcasts are not really practical, since the BBC wants to reserve the right to extend its programmes at night without notice). The advantages of broadcasting in the early morning - rather than between 3.45 p.m. and 5.25 p.m., the only other alternative - is that the vast majority of students will at least be home. Whether they will be able to

study at those times, however, nobody knows. Early morning broadcasts however again allows the major instructional characteristics of the University to remain unchanged, although there are likely to be a significant group of students for whom this policy will cause problems and for whom alternative arrangements - such as availability of programmes at study centres - will be necessary.

(e) Dropping repeats

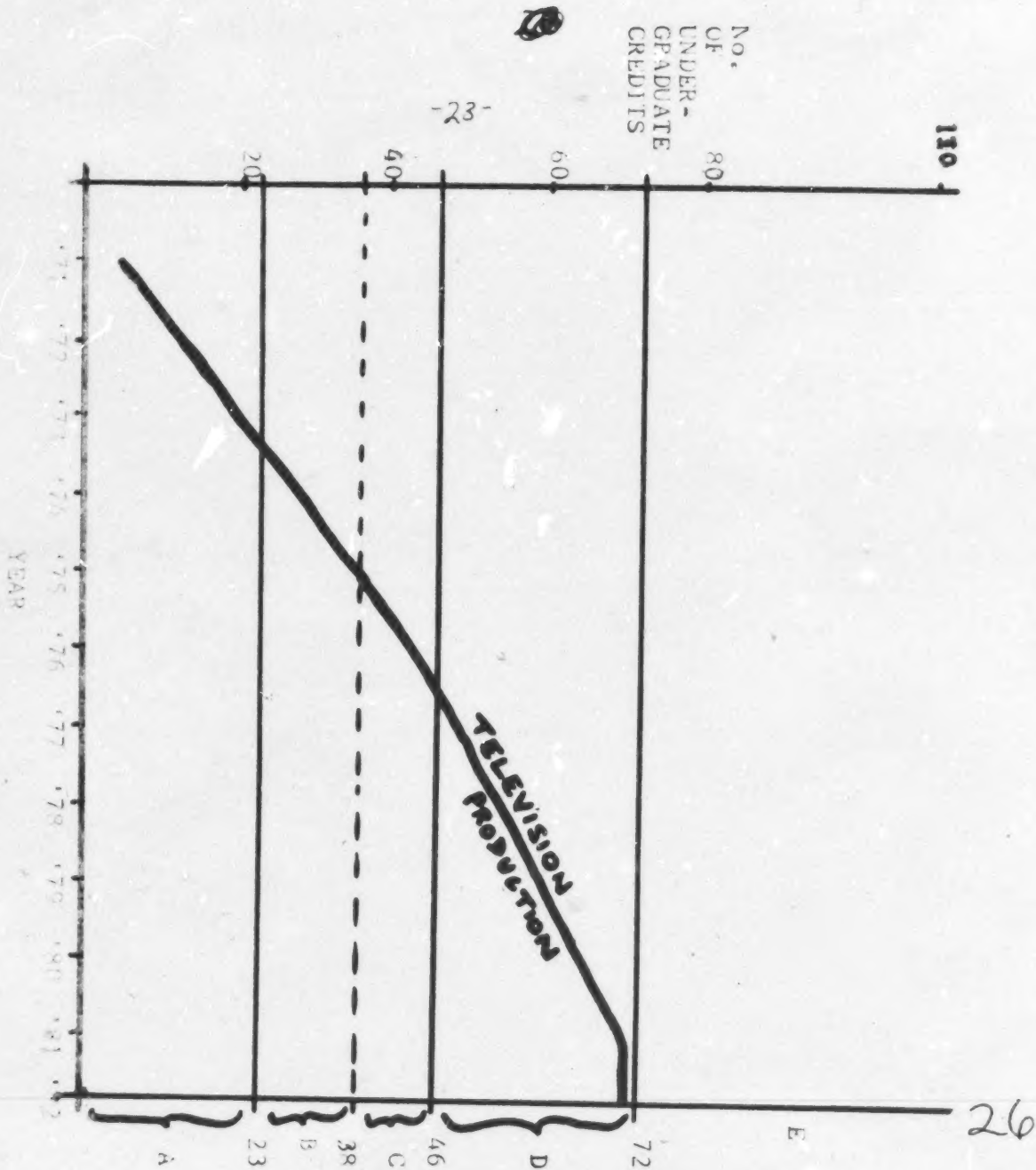
Even using early morning broadcasts the University could only put out 36 programmes a week, if each was repeated. Using a combination of no repeats and early morning broadcasts, the University could just squeeze in all its undergraduate broadcasts by 1971. Figure 5 shows the points at which each policy would have to be adopted. However, if a policy of no repeats and early morning broadcasts was adopted, this has important repercussions for course design. At the moment, one of the desirable instructional characteristics - integrated course design - has been slightly watered down. Since approximately 10% of students at the moment are unable to receive BBC 2, because they live in areas not covered by UHF transmissions, courses (except in Science) are so designed that students who do not watch the broadcasts are not directly penalised. This weakens the teaching potential of broadcasting (see Bates, 1973 b), but allows remote students, etc to remain in the system. In this case, a desirable instructional characteristic is subordinated to student needs. However, transmitting a programme once only at 6.00 a.m. can only be justified if the programme contains material central to the unit. The policy of many courses of making programmes in effect as "enrichment" material will no longer be tolerable. If programmes do however contain material central to the unit, alternative arrangements must be made for students who cannot get broadcasts. (Fortunately, by 1981 less than 2% of the population will not be covered by UHF transmissions). This might even take the form of issuing video-cassette machines individually to remote students on specific courses. (Numbers are not likely to exceed more than 200 on courses where television would be essential, and broadcast at inconvenient hours).

(f) Redesigning courses without broadcasts

Some courses may not have subject matter which requires the kind of audio-visual support which television provides. These

DECISION POINTS FOR TRANSMISSION TIMES

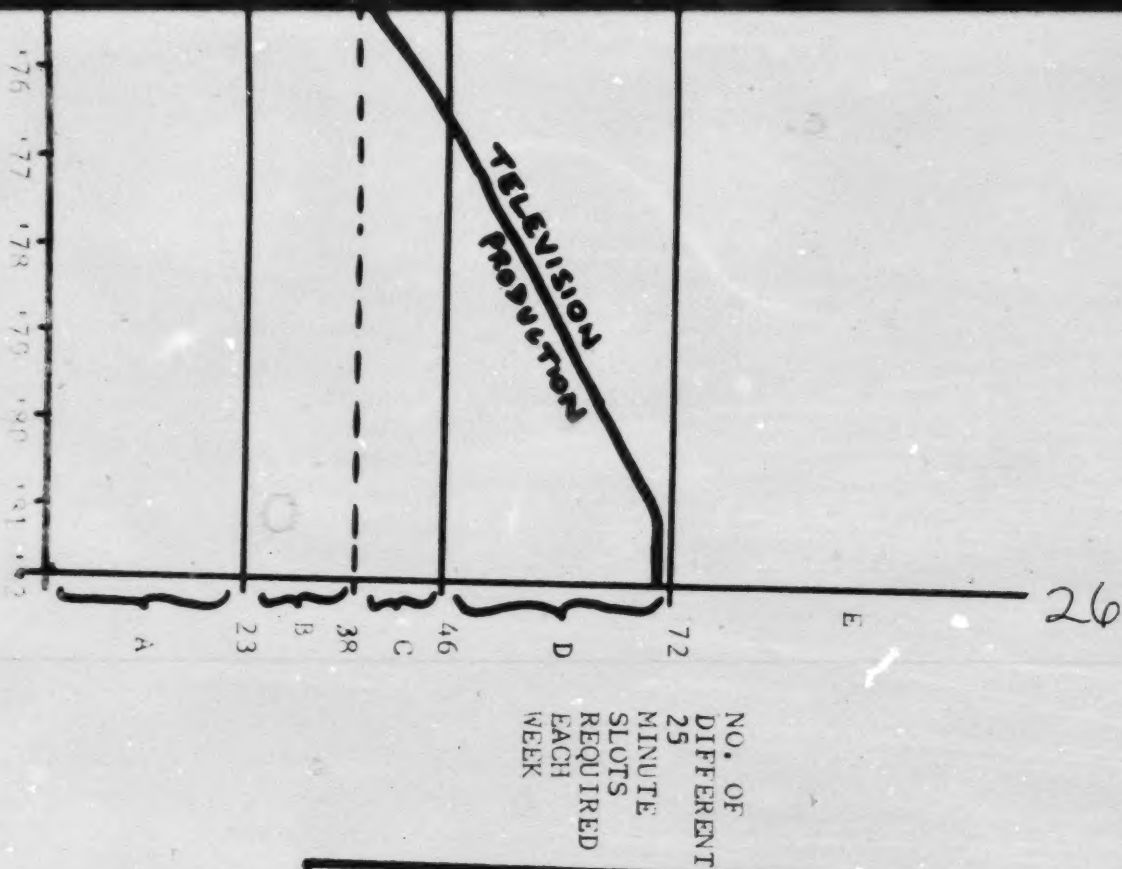
Figure 5



NO. OF
DIFFERENT
25
MINUTE
SLOTS
REQUIRED
EACH
WEEK

- KEY:**
- A: 1971-1973, repeats evenings, week-ends;
 - B: 1974-1975, repeats evenings, week-ends, early mornings;
 - C: 1976, no repeats, evenings, weekends 1977—, no repeats, evenings, week-ends, early mornings;
 - D: 1977—, no repeats, evenings, week-ends, early mornings;
 - E: All available slots filled.

Figure 5

KEY:

- A: 1971-1973, repeats, evenings, week-ends;
 B: 1974-1975, repeats, evenings, week-ends, early mornings;
 C: 1976, no repeats, evenings, week-ends, 1977—, no repeats, evenings, week-ends, early mornings;
 D: 1977—, no repeats, evenings, week-ends, early mornings;
 E: All available slots filled.

courses could use, instead of television, a combination of records (80% of our students have access to record players) or sound cassettes and printed material ("audio-vision"). It might even be possible to develop a cheap film/audio-cassette system, which could be issued to students on these courses. However, as has already been pointed out, subject matter is only one of several reasons why television is necessary. One essential aspect weakened by abandoning television is pacing; another is the ease of operation and clarity of visual and oral presentation of television; a third would be a weakened identification with course designers. Perhaps more important however is the range of objectives that can be covered in a subject area will inevitably be reduced without television. Special home-based gadgetry therefore will not only be an additional cost (since television will still be necessary for most courses), but some of the instructional characteristics of the system are likely to be weakened.

(g) Reduce the number of undergraduate credits

110 full credits means in effect about 200 different part or whole courses, since students can take half-credits (spread over 12 months) as well as full credits. On top of this, a post-experience course programme (i.e. courses which are self-contained, and not necessarily part of the undergraduate course structure) must be added. There is presumably a minimum number of courses the University can offer to remain academically respectable. This does not mean however that it needs to provide all the courses available in a conventional university. Indeed, there are some subject areas (e.g. medicine) which cannot be covered - and others which could not be covered as well by other institutions (e.g. mass communication). A reduction in the range and number of courses therefore would allow all the essential characteristics of the system to remain, and also alleviate the transmission problem.

It becomes clear that in the short-term, the University should

provide a blanket minimal service, each programme transmitted, even if at inconvenient hours, supported by flexible, local provision - VCR's at study centres, arrangements with local cable companies, individual arrangements for remote students - until more mid- and long-term solutions, such as an educational channel or an extensive, national cable network, become possible.

Conclusion

By applying the model, one can identify three kinds of solutions to the Open University's video-distribution problems:

- (a) short-term: use of early morning broadcasts; dropping of repeats; reduction in the number of planned credits; video-cassette back-up at study centres; individual provision for specific remote students; arrangements with local cable companies.
- (b) mid-term: a fourth educational channel.
- (c) long-term: an extensive national cable-network system.

The value of the model lies in being able to balance cost implications against the likely effects on student needs and the instructional characteristics of the system. There has not been space here to develop the alternative cost and pedagogic effects of various methods of using VCR machines for providing support at study centres, because we are in the process at this moment of carrying out such an exercise. However, it should be clear now that cost factors alone are not sufficient grounds for deciding on a video-distribution systems. It is also necessary - and possible - to take into account the educational consequences of such a decision.

*footnote to p.4: "previous educational qualifications" - all other characteristics are likely to influence - or be influenced by - the method of video distribution.

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